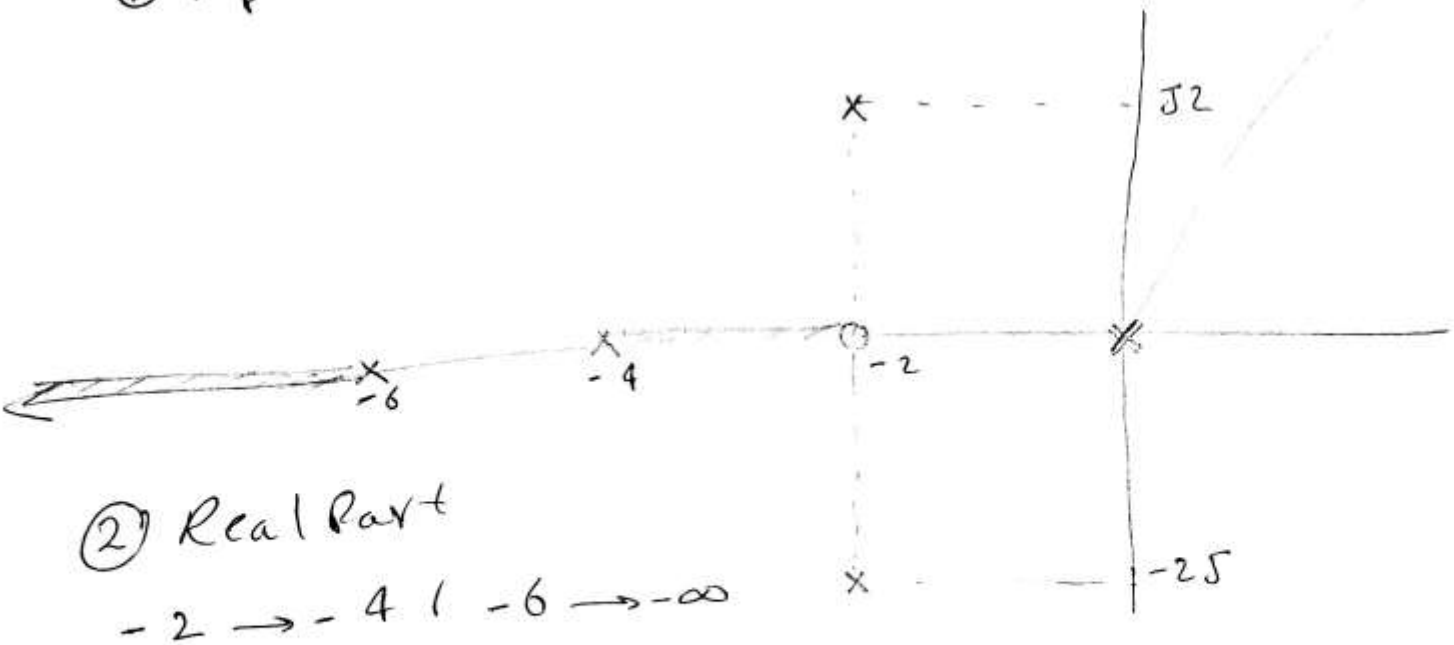
Control sec 4

$$GH(s) = \frac{K(s+2)(s+6)}{s^2(s+4)(s^2+4s+8)}$$

① $n_p = 5$, $n_z = 2$



② Real Part

$-2 \rightarrow -4$ | $-6 \rightarrow -\infty$

③ Asymptotes

$n_{o.} = 5 - 2 = 3$

$$C_A = \frac{(0+0-2+2j-2-2j-4-6)-(-2)}{3} = -5$$

$$\theta = \frac{(2L+1)^{*180}}{3} = (2L+1)60$$

$\theta \rightarrow 60^\circ$, 180°

(4) Breaking Points

Breaking in ... (zeros) بين ال

$$K = \frac{-1}{GH(s)} \quad s \quad \frac{-s^2(s+4)(s^2+4s+8)}{(s+2)(s+6)}$$

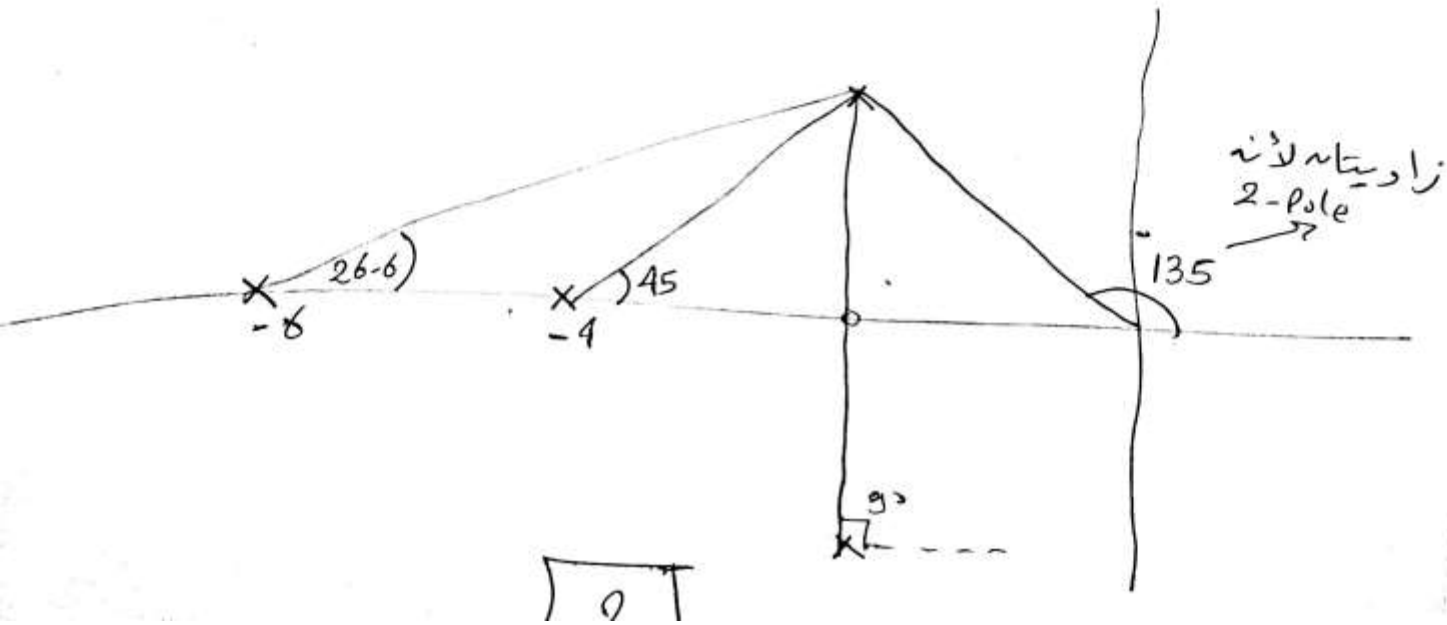
s	-6	-6-5	-7	...
K				

$K = \min$

← هنحسب قيم s في الجدول حتى نصل لقيمة تزيد عندها قيمة K تكون K_{min}.

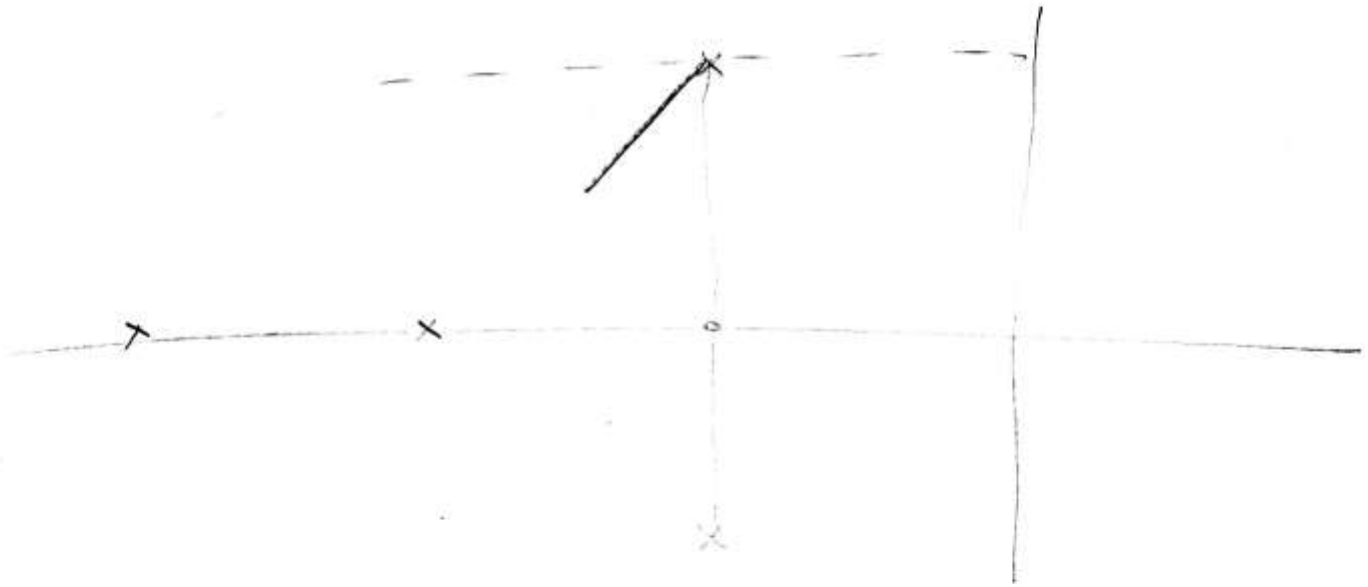
[5] Departure Angle.

$$D = 180 - \phi_P + \phi_Z$$



$$\phi_a = 180 - (135 + 135 + 135) + 90 + 26.6$$

$$= -108.4$$



(c) Range of K for stability (Routh)

$$1 + KGH(s) = 0$$

$$s^2(s+4)(s^2+4s+8) + K(s^2+8s+12) = 0$$

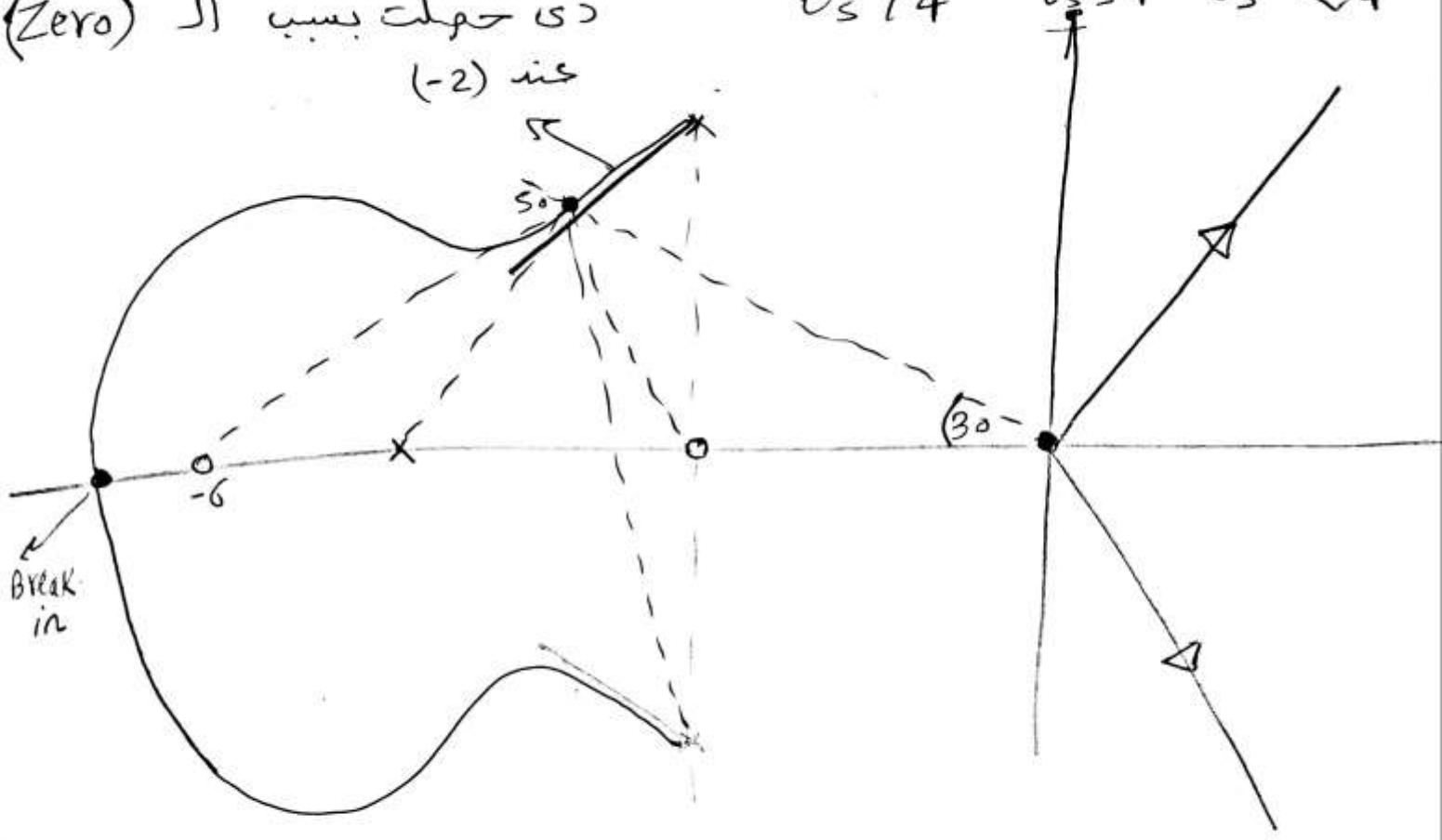
$$s^5 + 8s^4 + 12s^3 + (32+K)s^2 + 8Ks + 12K = 0$$

↳ Range of K.

(Zero) الـ حولت بسبب دي

(-2) عند

$t_s > 4$ $t_s = 4$ $t_s < 4$



Required

$\zeta = \frac{\sqrt{3}}{2}$, $t_s \leq 4$

$\hookrightarrow \theta = \cos^{-1}\zeta = \cos^{-1}\frac{\sqrt{3}}{2} = 30$

$K|_{s_0} = \frac{\Pi \text{ Poles}}{\Pi \text{ zeros}}$

$t_s = \frac{4}{\sigma} \Rightarrow \sigma = 1$

4

```
>> num = [1  8  12];
>> den = conv(conv([1 0 0],[1 4 8]
                ,[1 4]));
>> G = tf(num, den);
>> rlocus(G)
```